

Weather Note

HEAVY RAINFALL AT ISLAND FALLS, MAINE, AUGUST 28, 1959

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1. INTRODUCTION

A record-breaking excessive rain in Maine occurred on August 28, 1959, at Island Falls. It was especially remarkable in contrast to small amounts elsewhere in Maine on the same date. This paper presents the pertinent storm statistics, reviews the synoptic situation, and touches on the danger of using point measurements as representative of areal precipitation.

2. THE ISLAND FALLS STORM

Rain began near 1900 EST at Island Falls and ended near midnight, with an estimated 95 percent of the total falling in the 3 hr. from 1900 to 2200 EST, August 28, 1959. Two rain gages in town each measured 6.35 in. One was a standard Weather Bureau type 8-in. non-recording gage; the other a Stewart gage. These were operated by the Maine Public Service Co. and the Maine Forest Service. The records are considered to be reliable. The heaviest rain fell in a narrow band centered in or perhaps just north of Island Falls and extending westward or west-northwestward for nearly 12 mi. to just south of Mt. Chase (see fig. 1). A gage near Mt. Chase collected 3.06 in. The extremely local nature of the heavy rainfall is emphasized by an estimate of only 1 in. just 1 mi. south of town, where no water damage was evident. At Macwahoc, 28 mi. to the south, no rain was measured. At Dyer Brook, 5 mi. to the northeast, rainfall was light. Even midway between Island Falls and Dyer Brook, only little damage from washing rains was noted. No rain was measured at Squa Pan Dam, 35 mi. to the north. The band of damaging rain was only about 2 mi. wide and perhaps narrower in places.

Local estimates placed the storm damage at nearly one-quarter million dollars. One-fifth of this was to Federal, State, and local roads, private driveways, flooded cellars, and furnace motors and other equipment. Washouts of soil and field crops accounted for most of the damage. One-fourth mile of U.S. Highway 2 was badly washed out just north of town, with gullies 8 ft. deep and 10 ft. wide. One required 2,000 yd. of gravel to fill. Pavement and shoulders were washed out in places. One accident occurred when an auto ran into a washout. The hot-top paved road to Mattawamkeag Lake, from Route 2

to the Lake, was washed out for $\frac{3}{4}$ mi. and rendered completely impassable. Guard rails, posts, cables, and signs toppled like matchsticks before the torrent.

On Route 11, north of Patten and in Mt. Chase, 15 in. of water still covered the bridge over Sargent Brook the next morning. Nearby, on Allsbury Road, westward from Route 11, one washout extended for 500 ft. and two others were 100 ft. in length. Local streams, brooks, and both branches of the Mattawamkeag River were reported at flood stage the morning of the 29th. Pleasant Lake was said to have risen 15 in. Boats on Mattawamkeag Lake were filled and sunk by rainwater. Especially notable was the absence of wind during the storm. Windows in Island Falls did not have to be closed even at the height of the storm.

3. RAINFALL ELSEWHERE IN MAINE

Figure 1 is a plot of 24-hr. rainfall totals. As the time of observation may be in the morning, evening, or at midnight, the datum for each station was chosen so as to include the evening period during which the Island Falls rain occurred. At Upper Dam, where the observation time was 2100 EST, during the Island Falls rain period, a 48-hr. total is shown. Note that the greatest total for any of the regular Weather Bureau precipitation network stations is only 1.36 in., and this is on the western border of the State. The only other value greater than 1 in. was 1.19 in. at Old Town. Regular network data clearly fail to give any indication of the disastrous local washing and flooding rains at Island Falls. If one were to further restrict the network to the First-Order Weather Bureau Stations plotted on the Daily Weather Map, Caribou and Portland, only one had measurable rain. That, at Portland, was but 0.01 in. Network stations nearest to Island Falls are at Houlton, where only 0.25 in. fell at the FAA station and 0.59 in. at the cooperative station. Next nearest is Millinocket, where 0.01 in. fell at the FAA station and 0.08 in. at the cooperative station.

Press reports also described local washing and flooding rains at Old Town. There also the heaviest rain was very limited in area. Residents claimed that the 1.19 in. measured at the FAA station was much less than that received in most of the city. They also claimed that nearby communities received very little. Home and store

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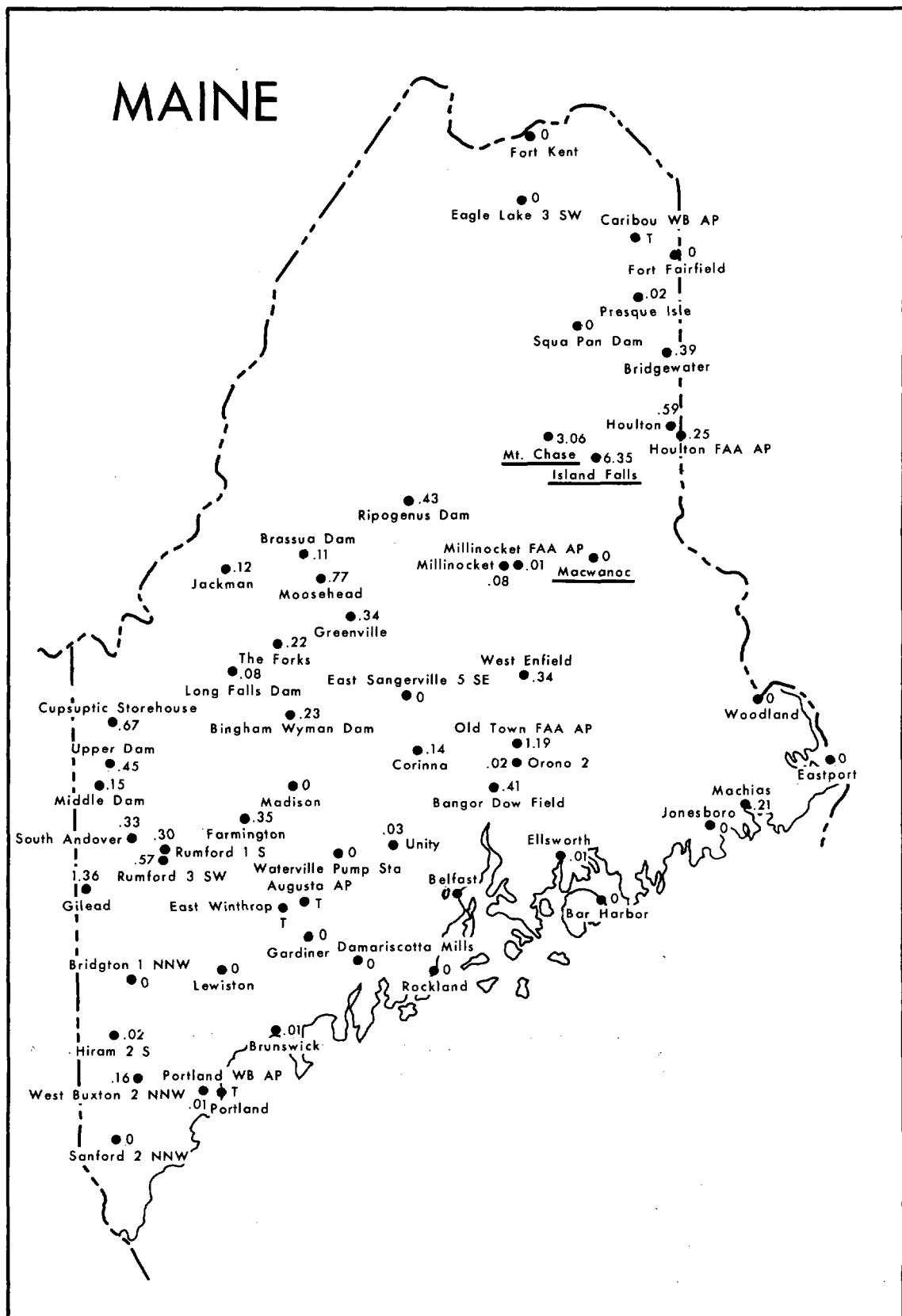


FIGURE 1.—24-hr. precipitation (in.) in Maine, August 28, 1959. Data are for U.S. Weather Bureau network stations, except for stations underlined.

basements were flooded in the city, damaging stock and equipment. Road damage was confined mostly to shoulder washouts.

4. COMPARISON WITH PREVIOUS HEAVY RAINFALL RECORDS

Though no recording gage caught this rainfall, estimates agree that nearly all the measurable rain came in a 3-hr. period. It is highly probable that at least 6.0 in. fell in the 3 hr. In the 11-yr. period, 1940-50, the heaviest rainfall in 24 hr. at any station in Maine equipped with a recording gage was only 5.85 in., at Greenville [1]. The record for 12 hr. in this period was 5.53 in., also at Greenville. For 3 hr., the published record is only 3.13 in., at Millinocket, roughly only half of the Island Falls rain. These records were not exceeded during the entire period of previous record at any First-Order Station.

Comparison with 24-hr. records for all cooperative stations, shows that 6.35 in. at Island Falls exceeds the record for nearly all Maine stations [2]. Higher values were recorded on only two dates, at any station. On September 16, 1932, totals at three stations were higher with the greatest, 7.72 in., at Ripogenus Dam. The other occurrence was during hurricane Edna, September 11, 1954 [3]. Edna gave four Maine stations amounts exceeding 6.35 in. The greatest, 8.05 in., was at Brunswick. On both earlier occasions heavy rain was general in Maine, while Island Falls in this instance stands nearly alone.

One cloudburst of greater intensity has been reported in Maine [4]. This was on August 21, 1939, at Baldwin, where the center of maximum yield was near Douglas Hill, the highest peak of the Saddleback Hills. Unfortunately, the area of extreme rainfall was devoid of rain gages. Results of a "bucket" survey gave estimates with a top value of 12 in. This rain also lasted about 3 hr., from 1430 to 1730 EST. This resulting flash flood took three lives when a bridge collapsed. The circumstances were quite different from those at Island Falls. The Baldwin case occurred in the warm, moist air associated with a tropical disturbance, when rainfall in substantial though highly variable quantity was common in Maine and over much of New England.

The average rate for the Island Falls excessive rain, 2.0 in./hr. for 3 hr., exceeds by far the intensity-duration value calculated to be expected once per 100 yr. for any First Order Station in the northern United States [5]. The 100-yr. return value of the greatest average rate for 3 hr. at most New England stations is near 1.0 in./hr., or about half that observed at Island Falls. Of New England stations, the greatest calculated rate is about 1.4 in./hr., for Providence, R.I. For Maine and other northern New England stations, the rate is near or less than 1.0 in./hr. for 3 hr. once in 100 yr. From atlas maps [6], the yield of 6.0 in. or more in 3 hr. in a 100-yr. period is expected only in relatively small areas of the southern United States, all south of the 36th parallel.

5. SYNOPTIC SITUATION

On the morning of August 28, 1959, the surface map indicated a broad trough from New England westward. To the north a moderately strong polar High was centered northwest of Hudson Bay; to the south a weak High covered the Southeastern States with a ridge connecting it to a strong central Atlantic High. A very weak, diffuse front lay east-west from Saint John, New Brunswick through Old Town, Maine, to Montreal, Quebec. Temperature and dew point contrasts within 200 to 300 mi. of the front were quite weak; to the north the cold air indicated about 67°-63°, the warm air about 75°-68°. All winds were less than 10 kt.

By midafternoon a weak wave could be identified on the front immediately north of Messina, N.Y., while the front itself remained quasi-stationary through central Maine. At midnight (0500 GMT), the front was very diffuse, apparently lying between Old Town and Millinocket, Maine. Considerable shower and thunderstorm activity was observed during the afternoon and evening, mostly south of the front, with some light rain reported at Millinocket and Houlton.

At 850 mb. (1200 GMT, August 28) the circulation was very weak with winds less than 10 kt. over New England. Winds were generally from 270 to 290 deg., with the exception of 210 deg., 4 kt. at Nantucket and 220 deg., 7 kt. at Portland. Temperatures in the warm air were about 18° C. with dew points of 12°-14°, in the cold air, 12° with 4° dew points. At 0000 GMT on the 29th, winds were still light, with a maximum of 16 kt. at Albany, and generally west-southwesterly. No definite trough could be identified.

At 500 mb. (1200 GMT, August 28), the only notable feature was some velocity convergence between 25-30-kt. winds in western New York State and southern Ontario and less than 20-kt. winds in New England. The flow was generally westerly to west-northwesterly with a rather weak temperature gradient. There was some indication of a moisture maximum along a line from Buffalo to Portland with dew point depressions of 2°-5° C. as opposed to depressions of 10°-15° C. to the north and south. By 0000 GMT on the 29th the velocity divergence was not so well defined although there were some directional differences (260 deg. at Caribou vs. 290 deg. at Nantucket). Curvature of contours in northern Maine was weakly cyclonic. The low dew point depression area was apparently centered between Portland and Nantucket, although it was also low at Caribou (4° C.) and Maniwaki (3° C.).

Soundings in the area antecedent to and concurrent with the heavy rains did not show any particular instability by any of the standard measurements (Showalter Index, parcel method, etc.). Use of Bellamy's [7] technique for computing divergence gave a value of -5.4×10^{-5} sec.⁻¹ at 10,000 ft. with weak divergence at 20,000 ft. and above in the Albany-Caribou-Nantucket triangle at 1200 GMT, August 28. By 0000 GMT, August 29, maximum conver-

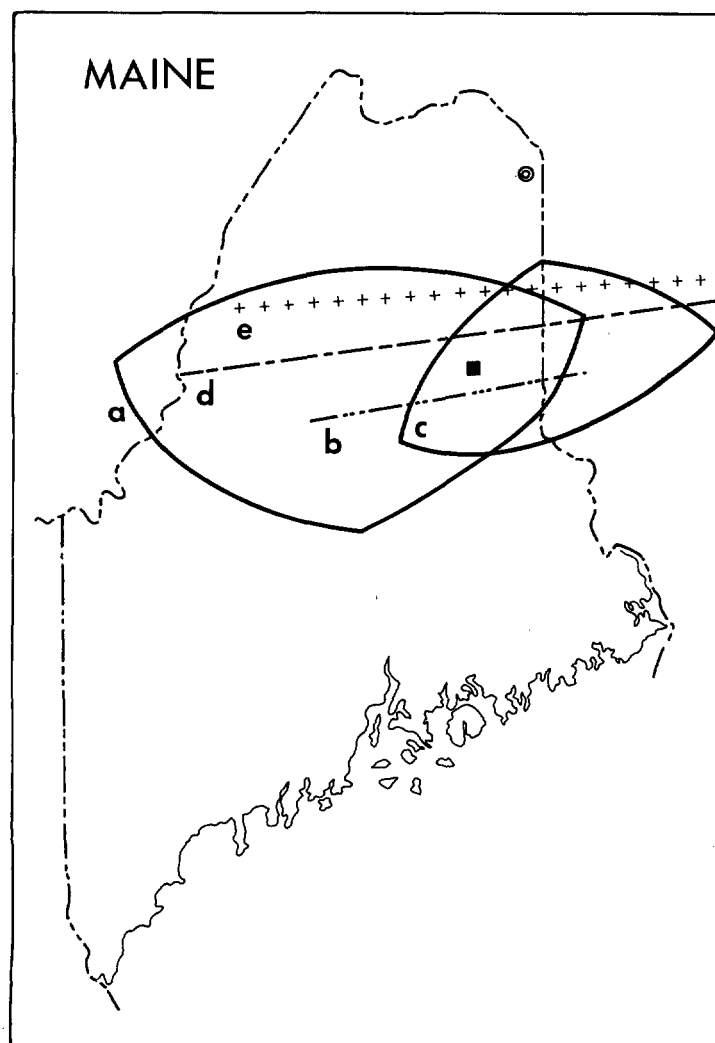


FIGURE 2.—Radar echo reports on August 28, 1959, from Loring Air Force Base, Limestone, Maine (located by circle). Time for echo area (a) 1740 EST, for echo line (b) 1840 EST, for echo area (c) 2040 EST, for line (d) 2240 EST, and for line (e) 2340 EST. Island Falls, Maine, is located by the square.

gence was near 5,000 ft. with a weak value of $-1.3 \times 10^{-5} \text{ sec.}^{-1}$, with increasing divergence above reaching a maximum of $+2.9 \times 10^{-5} \text{ sec.}^{-1}$ at 20,000 ft. These values are not particularly striking. Isentropic analysis failed to show any marked ascending motions, but this is a rather crude method to apply to a small area.

The indications are that this excessive rainfall was a mesometeorological phenomenon, as are most occurrences of this type. The nearest "representative" sounding (Portland at 0000 GMT on the 29th) was analyzed for precipitable water by Solot's [8] method; it indicated 1.92 in. While this is a fairly high value, considerable convergence must have occurred in the Island Falls area, even though the existing circulation would cause some downslope effect in that area.

The only real clue to the synoptician that any activity was occurring in the region of Island Falls was the radar reports from Loring Air Force Base in Limestone, Maine. These indicated almost continuous echoes in the vicinity from 2040 GMT, August 28 to 0440 GMT, August 29 (fig. 2). Attenuation would account for the fact that the three later reports (0140, 0340, and 0440 GMT) were all north of the storm area.

Since the line of rainfall was downwind from Mt. Chase, one might suspect horizontal convergence in the lee of the mountain. Why similar phenomena did not occur in the lee of other mountains nearby (Katahdin, for example) could be explained only by a denser network of observations in the area.

6. CONCLUDING REMARKS

While conditions were generally favorable for thunderstorm activity, the excessive rain at Island Falls is evidently a mesoscale problem. Though the yield was greater than any measured previously in Maine and other northern States in a 3-hr. period, it is not reasonable to conclude that this phenomenon has not happened before. Similar storms may occur upon occasion. The chance of so small a storm being caught in an official gage network is small. This one was caught only by non-network gages. Meteorologists are aware of the random nature of summer storms and resulting large variation of local precipitation. But lack of sufficient data and the pressure of daily routines frequently cause point measurements to be applied to relatively large areas. The Island Falls storm should serve as an extreme example of the danger in such interpolations.

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